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Face Mask Detection by Using Convolutional Neutral Network and Tensor Flow

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Abstract: Due to this pandemic situation, the WHO introduced that every person must to wear the mask against the deadly virus (COVID-19). The basic aim of our project is to predict the face mask on human face or not. Nowadays, 60% of people are not wearing the mask while going outside. So, it leads to increase positive cases and spreading of disease. Also, rapidly increasing day-by-day because of these critical situations many countries are trying to protect the people but most of them are roaming outside without wearing mask. To overcome this critical situation, we created the Face Mask Detection Model to detect whether the person is wearing mask or not and deployed in Real Time Web application. We implemented the dataset in Convolution Neutral Network and by using Tensor Flow we trained Face Mask Detection Model. Finally, we test the results in Real-Time Web application using Web Framework. Alongside this, we have used concepts of neutral networks and output will be shown in Real Time web application whether the person is wearing mask or not. In our project, we can easily predict the person individually and control the spreading of disease day- by-day. This project can be used in Non-Crowded areas like Malls, Metro, Banks, IT Companies, etc…
keywords: Tensor Flow, Keras, Web Design, Face Occlusion and Neutral Network.

1. Introduction

Face recognition technology is becoming increasingly important in our everyday lives. Face detection under various illuminations and facial occlusions becomes a hotspot for regression analysis [1]. Regression analysis' main goal is to retrieve clean images from clean training samples. We present a new occlusion detection approach that uses both raw and processed images [2]. We also demonstrated that using the non- occluded portion of the image for face recognition outperformed using the reconstructed image [3]. Proposed method for identifying occluded faces and recognizing them with the aid of identical faces in the dataset [4]. It's one of the issues with verifying or recognizing a face from a question or input image. It' s used in a range of applications, including video monitoring, human-computer interface (HCI), facial recognition, and image database management. It can happen for a variety of reasons, both deliberate and unintentional.

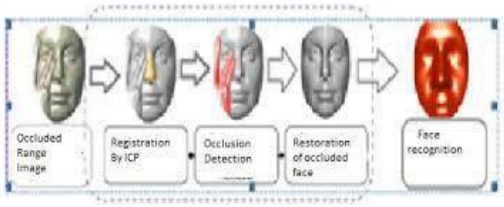

FIGURE 1.

This helps us to detect the presence of occlusion at the pixel level, retaining as much face detail as possible for identification. Face occlusion is an important technique for capturing photographs of human faces in our project.

Related Works : To construct a binary face classifier that can identify any face in the frame, regardless of its orientation. The aim of the research was to use Completely Convolutional Networks to semantically segment out the faces in the picture [5]. In the security scene of IOT, a novel face occlusion detection system is used to identify certain crime behaviors. First, we present a new face detection algorithm based on the energy function; second, we use CNN models to construct deep features of occluded faces. Finally, a novel sparse classification model with deep learning scheme is designed to see if the detected face is occluded [6]. The primary focus of this research is on facial masks, specifically how to improve the recognition accuracy of various masked faces [7]. It proposes an individual re-identification association-based masked face recognition approach that transforms the masked face recognition problem into an association uncovering problem between the masked face and the appearing faces of the same person [8]. The multi-task CNN will predict the coverage of various facial sections, such as the left eye, right eye, nose, and mouth. Using an error detection system, it proposed a novel method for occlusion face recognition. First, a face image is divided into four regions, with each region having its own feature extraction and error detection. Second, it is used to calculate the logarithmic transform error operator the weight value of each region [9]. Face occlusion handling under the sparse representation based classification (SRC) [10] paradigm has recently demonstrated promising results in occlusion face recogni-

tion. Wright et al. [11] proposed using SRC for occluded face recognition, in which an occluded face is defined as a linear combination of the entire face gallery plus a vector of errors (occlusion) at the pixel-level, with classification achieved by L1 minimization. By using a Markov Random Fields model, Zhou et al. [12] expand [13]. (MRF) To address contiguous occlusions, create a model that enforces spatial continuity for the additive error vector. To minimize computations in the presence of occlusions, Yang and Zhang used compressible image Gabor features instead of original image pixels as the feature vector in SRC [14]. To achieve alignment, Liao and Jain [15] integrated the SIFT descriptor into the SRC system. Yang et al. [16] proposed a robust sparse coding (RSC) method for non-Gaussian/Laplacian occlusions that iteratively seeks the maximum likelihood estimation (MLE) solution of the sparse coding problem. Despite the fact that SRC-based approaches successfully identify occluded faces from standard face databases, The use of a large number of training samples of each identity with appropriate variance is a requirement of those methods. However, in many realistic face recognition scenarios, each subject's training samples are often inadequate [18].

Existing System: In existing system, the Face Mask Detection Model is already implemented by using MATLAB and python. In python, some of the methods like OpenCV and cascade classifier are used. By using OpenCV method, the major problems is that are uploaded their own images to create dataset the accuracy is too low and OpenCV is used for recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras and stitch images together to produce a high resolution image of an entire scene. In Cascade Classifier method, the major problem its accuracy is best in object detection when compared to face detection and it is trained using a sample that contains a lot of positive and negative images it also consists of a set of simpler classifiers which are applied to the region of interest until the selected object is discarded or passed.

2. Proposed Model

To overcome the above problems, we proposed a system, Real Time Web Application for Face Mask Detection Model. In this application, we are creating web page where the developed front end with the help of markup language and train the Face Mask Detection Model. By using the Web application, considering each image in web page and compared with the model, then predict the output and shown the result. Once the input of images are given to the web page, the model we get the images by back end connectivity and detect the output. At last, the result will show in web page. We are implemented this project in Real Time web Application and it can be used in Real Time World for monitoring purpose.

Steps To Be Followed

- If existing user, sign in to proceed for further process.
- For new user first they want to sign up to access.
- Capturing the images of person in web page.
- Captured images are saved in directory.
- The images are imported to the model.
- Finally, the result of detection is shown to the user.

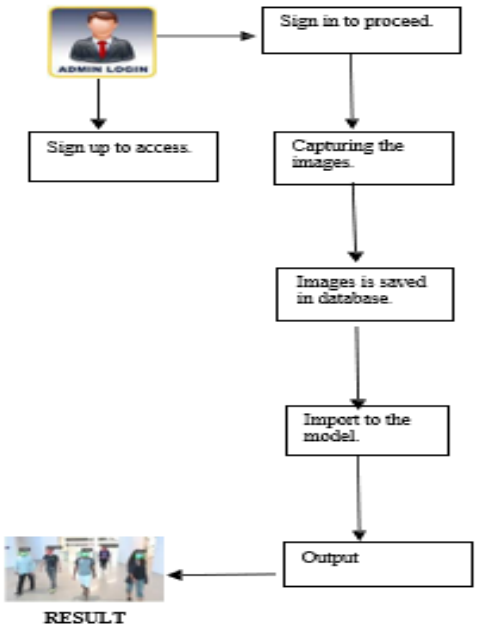

FIGURE 2. Architecture diagram of Face Mask Detection Model in Real Time web application

3. Modules Data Preprocessing

In this module, the first and foremost step is to collecting the dataset. We have collected a dataset from Kaggle platform based on Face Mask Detection Model. Basically, the dataset consists of two types such as human face and face wearing mask. The dataset is a JPEG file format data which consists of n number of

FIGURE 3.

The dataset consists of three folders such as train, test and validate. We are going to select or extract the features from the collected dataset. Thus, in this module Data Preprocessing will be completed. Deep Learning Mechanism: In this module, we evaluated our detection scheme based on the Deep Learning mechanism. There is lot of mechanism in Deep Learning model, the best algorithm is used in our model, it is obtained from tensor flow. In tensor flow, keras is a powerful and easy to use free open source python library for developing and evaluating deep learning model. It wraps the efficient numerical computational libraries like tensor flow and allows you to define and train neutral network in just a few lines of code. We are working on the sequential model in Deep learning mechanism. It allows building a model layer by layer and it is the easiest way to build a model in Keras. A neural network takes in inputs, which are then processed in hidden layers using weights that are adjusted during training. Then our project spits out for prediction.

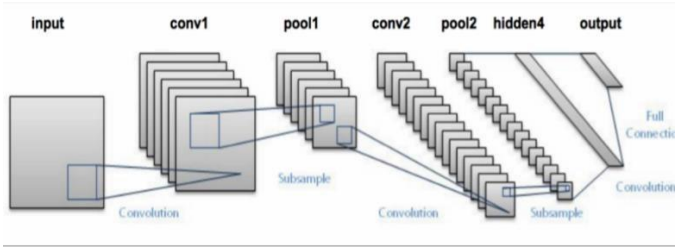

FIGURE 4.

Our project consists of three parameters: train generator, test generator and valid generator. The train generator is used to train the model with certain set of images in dataset. The purpose of test generator is used to check of accuracy and loss percentage with n number of input images. The valid generator is used to validate the model with good performance. Finally, we would use the 'predict()' function, passing in our new data. The output would be 'wage_per_hour' predictions.

4. Performance Statistics

In this module, we are working for performance statistics in the sequential model of deep learning mechanism. The performance statistics shows the accuracy and value loss of the model.

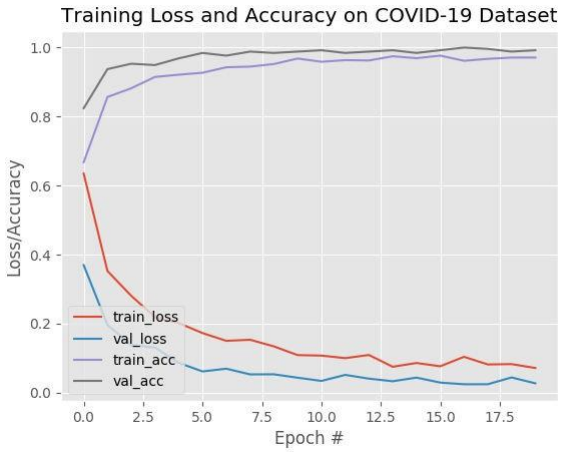

FIGURE 5.

In our project the performance statistics shows the 92% of accuracy and 0.10 value loss for the model. It produces the best results to train, test and validate the Face Mask Detection Model. Web Design: In this module, the web design is created by using front end such as HTML, CSS and JavaScript. In the web side the user have to login by giving their login details. Basically the login details consist of username and password. If, the user doesn't have login credentials the user should create a new account. Once the user is logged in successfully, then the user can visit the home page which can accessed by the client.

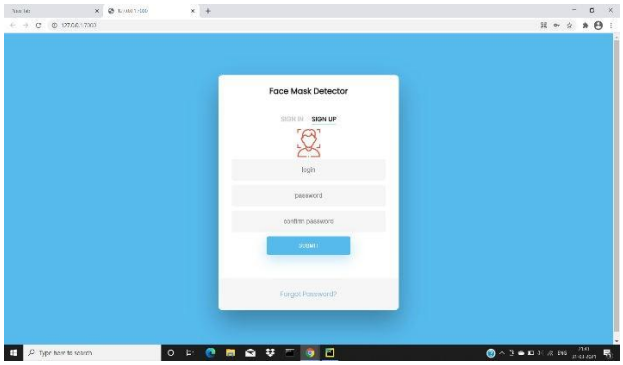

FIGURE 6.

In home page the permission of webcam access is alerted by the user. After accessing the webcam the image of the person can be taken by the user as input. The back end connectivity is developed in flask framework the input image is paused from webpage to model by flask framework. After compiling the model the output passed by back end connectivity and displays the result in home page to the user. In home page the user can view the current status of the record and also download for their references. The user can also view the record of the person wearing the mask and not wearing the mask in home page. Data base: In this module, the Database is stored the input image into two parts there are person wearing the mask and not wearing the mask. The Database is managed to count the number of person who are entered. The result of the count always compared to the sufficient occupy rate which as default value is updated by the user. The occupy rate is fixed by the rules and regulations followed by government.

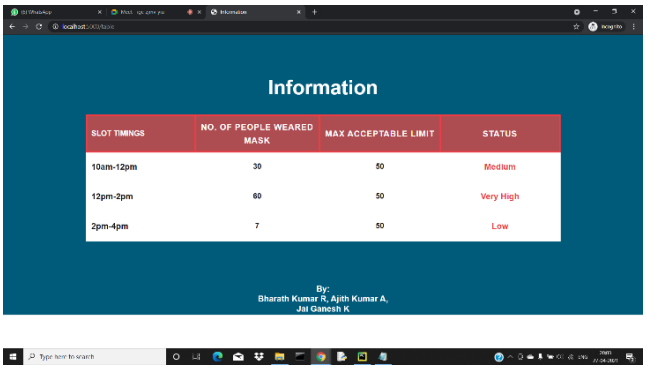

FIGURE 7.

If, the occupy rate is more than the count the Database will passed the alert message. The user can download the record of the current status from Database to their local computer.

Advantages: The Face Mask Detection model has some of the advantages to discuss about; it is very user friendly environment. This model can be accessed by authorized person because it provides more security. Then, it is used to control the spreaders of the disease. Finally, providing transparency to our clients.

5. Experimental Results

Sign up details

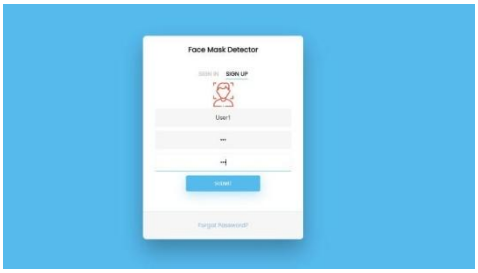

FIGURE 8. Sign-up Details page

In this figure, where user can create their account by giving their username and password.

Successful creation of sign up details:

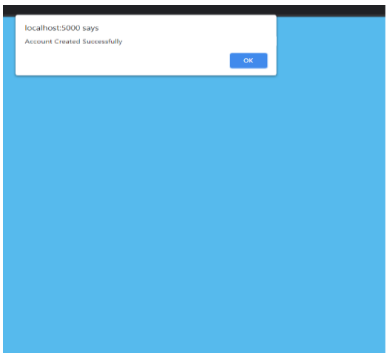

FIGURE 9. Successful creation of account

In this figure, which the user can create the account successfully.

Sign in details:

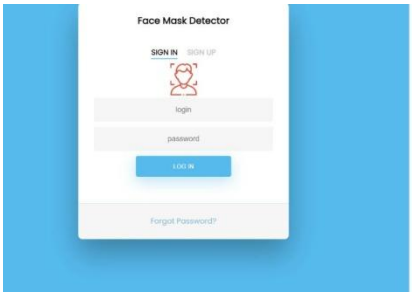

FIGURE 10. Sign-in Details page

In this figure, where user can access by giving their username and password.

Successful creation of sign in details:

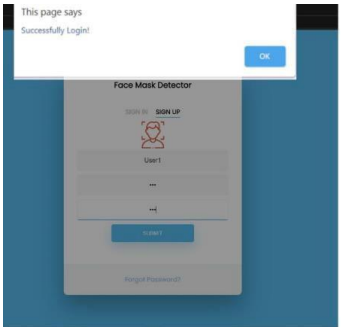

FIGURE 11. Successfully Logged-in page

In this figure, where the user can login successfully.

Human wearing face mask:

FIGURE 12. Wearing face mask

In this figure, where the user wearing the mask.

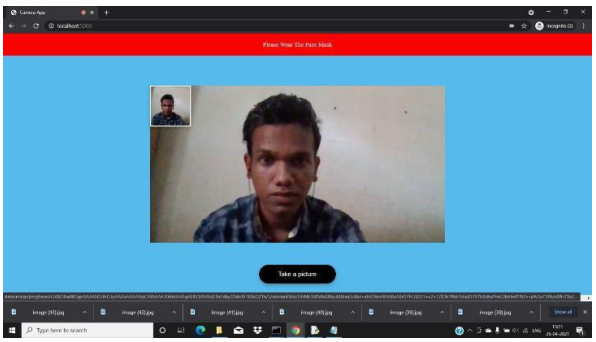

FIGURE 13. Without Wearing Mask

In this figure, where the user is not wearing the mask.

Home page:

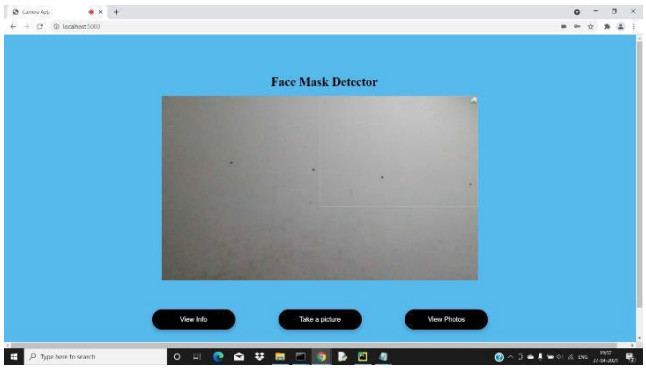

FIGURE 14. Display of Home Page

Human without wearing mask:

In this figure, where the user can capture their face image as input.

Database table:

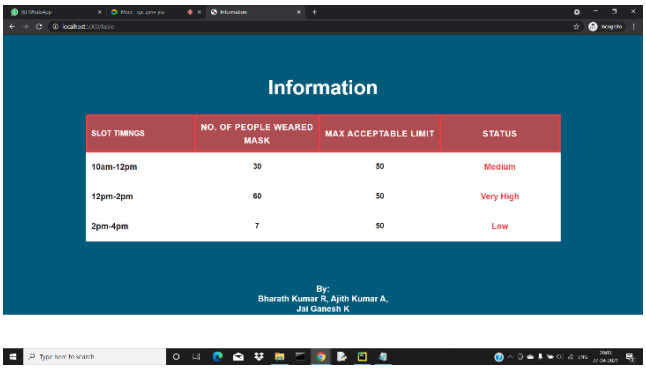

FIGURE 15. Display of Database Table

In this figure, the table shows the count of people wearing mask, occupy rate and status.

6. Conclusion and Future Works

In our Approach, we proposed a new model the Face Mask Detection in Real Time Web application. Our model is accurately predict whether the person is wearing mask or not. The Py Charm environment is very useful to implement our codes and it is very user friendly. Then, we import some of the packages such as Tensor Flow, Keras, numpy and OpenCV in anaconda environment. With the help these packages we implemented our project successfully. The web page is designed in our project to show the results in Real Time Web application. Our project is very user friendly and it access to the authorized person. In our future works we are going to extend the features of dataset and to deliver our project as a product. Then, we are planning to detect the person is wearing mask or not via livestream. Finally, we are also planning to detect multiple faces in single frame where group of people images are captured.

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